

The Relationship between Lyme Disease and Landscape Development Pattern

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The incidence of Lyme disease in the United States is on the rise. Low-density development is also increasing in endemic regions, raising questions about the relationship between development pattern and disease. This study sought to model Lyme disease incidence rate using quantitative, practical metrics of regional landscape pattern. The objective was to progress toward community development design guidelines that may help minimize human risk of environmental exposure to arthropod-borne disease. Ecologic analysis was used to accommodate the integral landscape variables under study. Case data were collected from passive surveillance reports across 12 counties in the US state of Maryland during 1996–2000; 2,137 cases were spatially referenced to residential addresses. Major roads were used to delineate 514 landscape analysis units from 0.002 to 580 km². Land-cover pattern was measured using 30-m resolution satellite imagery and a geographic information system. The parameter that explained the most variation in incidence rate was the percent of land-cover edge represented by forest adjoining lawn and other herbaceous cover ($R^2 = 0.75$; rate ratio = 1.34 [1.26, 1.43], $p < 0.0001$). Also highly significant was percent of the landscape in forest cover (cumulative $R^2 = 0.82$), which exhibited a quadratic relationship with incidence rate. Modeled relationships applied throughout the range of landscape sizes. Results begin to provide quantitative landscape design parameters for reducing casual peri-domestic contact with tick and host habitat. The final model suggests that clustered forest and herbaceous cover, as opposed to high forest–herbaceous interspersed, would minimize Lyme disease risk in low-density residential areas. Higher-density development that precludes a large percentage of forest–herbaceous edge would also limit exposure. Risk reduction efforts may be most effective at the community, rather than the individual, level.

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